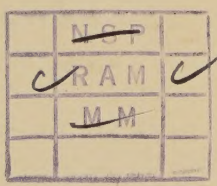
AN FORAS TALUNTAIS

(The Agricultural Institute)

TECHNICAL PROGRESS REPORT, 1959-60

PLANT SCIENCES & CROP HUSBANDRY DIVISION



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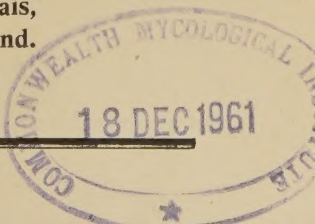

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AN FORAS TALUNTAIS

(The Agricultural Institute)

PLANT SCIENCES & CROP HUSBANDRY DIVISION

Technical Progress Report, 1959-60

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To the Chairman and Council of An Foras Taluntais

I have the honour to present to you this first series of Technical Reports covering the research programme of An Foras Taluntais. There is a separate report for each of the five research Divisions.

As the programme (apart from some facets of the work of the Soils Division) has only been under way for some two years - much less in some Departments - no conclusive results can yet be expected. Nevertheless, we trust that the data now presented, even though in summarised form, may be of value to advisors and to research workers interested in the several fields to which the reports relate. As the projects are completed, full details will be published in scientific publications and indeed a considerable volume of material has already been so published.

The present series refers to what is only the initial development phase of a programme of agricultural research which you decided should be geared specifically towards providing the research support essential to meet the immediate needs of the drive towards national farming progress. This programme has been planned in close co-operation with the various farming, advisory and official interests concerned. In assessing the progress made by reference to these reports you will appreciate that in the initial stages suitable facilities were very limited and the required complement of staff fully trained in research methods was not readily available.

I feel that you would wish me to express on your behalf thanks to the various people who have so generously helped us during the period under review, especially the Minister for Agriculture and the staff of the Department of Agriculture; the University authorities; Comhlucht Siuicre Eireann Teo; the advisory services and the various farming organisations, and also the many organisations and research workers from outside the country whose assistance we gratefully acknowledge.

T. Walsh
Director

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* Joined staff 1960

TECHNICAL PROGRESS REPORT
OF THE
PLANT SCIENCES AND CROP HUSBANDRY DIVISION

INTRODUCTION

In the Plant Sciences and Crop Husbandry Division the aim is to conduct research which will ultimately enable the farmer to produce the highest crop yields of the best possible quality for the nutrition of man and beast.

This is being done partly by the development of better varieties by breeding in conjunction with chemical analysis and partly by improved methods of culture and plant protection.

To facilitate the working of the Division the following departments and units have been set up:-

1. Plant Breeding
2. Cereal Chemistry
3. Nematology
4. Crop Husbandry
5. Plant Pathology
6. Plant Chemistry and Biochemistry

The Plant Breeding Department includes a cytology unit while it is intended to establish a Department of Applied Plant Genetics in the near future.

By arrangement with the Irish Sugar Company, the headquarters of the Division and a portion of the Plant Breeding Department are situated at Thurles, Co. Tipperary.

The majority of the Division's field experiments are being conducted at Oakpark, Carlow, where laboratories and other accommodation are now being provided.

Other field trials were laid down at Johnstown, Moorepark, Kinsealy, Dungarvan, Clonroche and Derrybrennan. In addition to the field trials on Institute farms, controlled field experiments are conducted on the farms of the agricultural schools of the Department of Agriculture and on the lands of many farmers in co-operation with the Advisory Services.

While the more detailed accounts of the work in progress or completed at the end of 1960 will be found in the individual reports of the departments, the activities of each may be briefly summarised as follows:-

1. Plant Breeding:

This department deals with the breeding of sugar beet, fodder beet, swedes, kales, rapes, potatoes, grasses and clovers. In the case of each species the aim is to produce disease resistant varieties having the highest yielding potentiality combined with high quality and suitability for the purpose for which they are to be used.

The cytology unit gives invaluable service in the Plant Breeding Department. By producing tetraploids of desirable lines of plants quite new possibilities of advancement are opened up.

The Department of Applied Genetics when established, will employ irradiation to accelerate the occurrence of mutations. It is highly probable that some of these mutations will display hitherto unknown characteristics such as greatly improved quality or disease resistance.

2. Cereal Chemistry:

Research in this department has so far centred on wheat quality. Very valuable fundamental work has already been done on the milling and baking qualities of Irish wheat. While these investigations will be continued and intensified, similar work is being undertaken on barley and oats.

3. Nematology:

In this department research work and surveys are continually being conducted on the nematode parasites of sugar beet, potatoes, cereals, grasses, clovers, vegetable and fruit crops and mushrooms.

4. Crop Husbandry:

This department investigates the effects of different methods of cultivation and different rates of fertiliser application on crops. It also examines the effects of controlled light and temperature on the sprouting of potatoes and the effects of time of sowing and time of harvesting on various crops.

A broad programme of chemical weed control experiments has been undertaken, while a wide range of chemical seed dressings and selective herbicides are in the process of evaluation.

Attempts are also being made to discover new crops abroad which might be adaptable to profitable cultivation in this country.

5. Plant Pathology:

The staff of this department are located at present in the Plant Pathology Department of University College, Dublin, the Head of which acts as adviser to the Institute.

The work of the department has so far been concerned mainly with the diseases of cereals and root crops.

Methods of reducing the incidence of take-all and eyespot in wheat and barley are under investigation. Various cultural, rotational and fertiliser treatments are on trial.

Club root in brassica crops and downy mildew in sugar beet are being attacked mainly by the selection of resistant lines in conjunction with the Plant Breeding Department.

Virus free lines of raspberries and strawberries are being propagated.

6. Plant Chemistry and Biochemistry:

This department was set up at the end of 1960. In the beginning its work was concerned with the chemical analysis and quality evaluation of sugar beet. As the department expands fundamental research will be conducted into the factors influencing quality in all crops.

The conducting of several of the above research projects calls for the participation of officers in more than one department. There is the closest collaboration between the various departments and and between these departments and other Divisions as is exemplified by the laying down of field trials at practically all the Research Centres of the Institute.

Apart from carrying out research the various departments provide as required, scientific information and specialist advice for the agricultural advisory services.

PLANT BREEDING DEPARTMENT

(a) SUGAR BEET

B. Crombie

The breeding of sugar beet continued, emphasising the importance of yield potential combined with a high sugar content, high juice quality, bolting resistance and disease resistance.

Seven large field trials were laid down to test 22 varieties while in another very large trial 121 varieties, strains, and family groups were tested. The different varieties in these trials gave quite a wide range of performance in regard to yield and sugar content with some of the newly produced polyploids surpassing all other varieties in these respects. Early and late harvestings in these trials showed that an appreciable yield increment of roots and of sugar was obtained between mid October and early December.

A bolting trial sown on 20th March, 1959, and comprising 81 varieties, strains, and family groups, gave an incidence of bolting ranging from 2 per cent to 48 per cent. Selections previously treated in this manner and repeatedly sown early have produced some highly bolting-resistant strains. Many of these strains, sown on 25th March, 1960, gave no bolters at all by the end of September.

The capacity of sugar beet strains to germinate at low temperatures in harsh spring weather is being improved to make the new bolting-resistant strains more suitable for early sowing. Seeds of the selected strains are put to germinate at 42° F and only the seedlings capable of emerging at this temperature are grown on for further propagation.

A severe outbreak of downy mildew in the large field trial in 1959 revealed a very wide range of resistance in different lines of breeding material. On the whole, tetraploids were much more resistant than diploids. Under conditions of heavy artificial infection in 1960, these resistant lines again showed their superiority in downy mildew resistance. Selected roots have been taken from the highly resistant lines in both tetraploids and diploids for further propagation.

Polyploid Beet: Diploid or ordinary sugar beet contains 18

chromosomes in the nucleus of each cell. When the chromosome number is doubled by treatment with a drug, colchicine, the resulting plant is called a tetraploid (36 chronosomes). The tetraploid crossed to the diploid beet gives a triploid (27 chromosomes). The progeny obtained by blending tetraploid and diploid parent plants is known as polyploid. Due to random pollination in the field this polyploid mixture consists of approximately 50 per cent triploid, 25 per cent diploid and 25 per cent tetraploid plants.

The new polyploids have exceeded diploids in every respect - yield, sugar content, bolting resistance and disease resistance. The best diploid and tetraploid parental lines have been combined to produce the entire commercial seed crop for the 1961 harvest.

MONOGERM AND MALE STERILE SUGAR BEET BREEDING

J.B. MacLachlan

In order to meet the rising demand for more mechanisation and a reduction of labour in the singling of sugar beet, work on the breeding of monogerm sugar beet has been in progress for some time. The original monogerm seed, from which breeding began, originated in the U.S.A. These plants had a low sugar content and a poor root yielding capacity. The aim is to produce a commercial variety of monogerm sugar beet possessing all the desirable characteristics of the multigerm beet. To do this it is necessary to cross and back-cross the monogerm beet several times to a high quality commercial variety.

Work carried out during 1960 included the laying down of an observation plot, containing lines of seed from selfings, crosses, and elite seed plots of 1959.

Monogerm plants were selected in progenies of previous crosses and were used in further crosses to good multigerm plants to improve quality. Polythene cages were used for this work.

Male sterile plants were also selected and used in crosses to normal multigerm and monogerm pollen donors to isolate type O plants. These are plants which produce an entirely male sterile population when used as pollen donors for male sterile plants. Type O plants occur as a very small minority in ordinary sugar beet varieties and can only be discovered by extensive test crossing.

Multigerm plants were cut out of elite seed observation plots containing segregating populations, and monogerm plants retained to give seed which will be tested in trial fields in 1961.

Tetraploid monogram seed was raised in the glasshouse.

A pilot experiment was carried out in the glasshouses on the chemical induction of male sterility in seeding sugar beet plants, and a further experiment will be carried out in 1961.

CYTOLOGICAL INVESTIGATIONS

S. Forde, E. Dwyer

During the year January 1960 to December 1960, most of the cytological work was connected with sugar beet *(Beta vulgaris)*. Numerous mother roots and seedlings were checked for ploidy. Several new strains and family groups were tetraploidised and this involved a lot of chromosome counts.

Seedlings of fodder beet were checked for ploidy. Samples of *Brassicae* were also examined to identify their species by chromosome counts. Grasses were tested to estimate their pollen fertility.

In addition, the following experiments were started:-

(1) A comparison is being made between two methods of colchicine treatment for inducing tetraploids in beet; the finalised results will be available in the coming year.

(2) A ploidy check was made on polyploid mother roots that had undergone a complete chemical analysis in the Beet Laboratory. Weight, sugar content, purity, brix and ploidy are now available for the individual roots and can be tabulated accordingly with a view to determining the range of variability within the different ploidy groups.

(3) An experiment was carried out on the screenings of polyploid seed and a ploidy check was made on the seeds from the different screenings.

(b) ROOT AND FODDER CROPS

D.P. Feely

Root and fodder crop variety trials were carried out in 1960 at Thurles, Moorepark, Johnstown Castle and at the Department's Agric-

ultural schools at Athenry and Ballyhaise. Randomised blocks were used in all the trials with five replications.

In the fodder beet-mangel variety trials, 12 varieties of fodder beet and four of mangel were included. Summary of results is given in table I. *(hereunder)*

Sixteen varieties were included in the swede variety trials and these included purple, green and bronze skinned types. Summary of results is given in table II. *(overleaf)*

Marrow stem and thousand head kale variety trials were carried out with twelve varieties of each. For marrow stem, the highest yielding variety gave 2.9 ton dry matter per acre, while the lowest gave 2.4 ton. The corresponding figures for thousand head were 2.4 and 2.0 ton respectively.

Trials comparing eight varieties of rape were carried out at three centres. Summary of results is given in table III. *(overleaf)*

Fodder beet and swede trials were carried out by the Agricultural Advisers throughout the country. Four varieties were included in each of these trials, and the summarised results are given in tables IV and V. *(overleaf)*

TABLE I.

VARIETY	DRY MATTER	YIELD OF ROOTS	YIELD OF DRY MATTER
Fodder Beet	Per Cent	Tons/Acre	Tons/Acre
Sugar Beet	22.6	16.5	3.70
Hunsballe XI	19.7	20.4	3.97
Hinderupgaard	19.3	21.6	4.11
Voedersuikerbeit CB	18.6	22.4	4.14
Pajbjerg Rex XI	18.3	18.6	3.81
Hvid Otofte XI	17.9	22.1	3.91
Red Otofte XI	17.0	22.0	3.67
Groenkragg CB	16.3	26.5	4.27
Bison	15.8	26.8	4.22
Pajbjerg Korsroe XI	14.8	26.3	3.85
Yellow Daeno XI	14.6	28.1	4.03
Barres Otofte Nova XI	13.8	27.3	3.69
Mangels			
Half Sugar Rose	12.9	29.2	3.64
White Knight	10.5	36.7	3.77
Lord Warden	10.1	35.3	3.50
Yellow Globe	9.7	37.2	3.50

TABLE II.

VARIETY	DRY MATTER	YIELD OF ROOTS	YIELD OF DRY MATTER
	Per Cent	Tons/Acre	Tons/Acre
Purple Skin Group			
Best of All	8.7	30.5	2.65
Tipperary	9.2	27.3	2.51
Magnificent	8.3	33.7	2.79
Superlative	8.7	26.3	2.28
Monarch	9.3	28.1	2.61
Acme	8.8	31.0	2.72
Townhead Purple Top	8.3	30.5	2.53
Champion Purple Top	9.0	26.0	2.34
Warrington	8.8	30.7	2.70
Bangholm Otofte XI	10.5	23.5	2.46
Bangholm Wilby Otofte XI	10.4	25.8	2.68
Bronze Skin Group			
Parkside Bronzetop	7.5	27.2	2.04
Conqueror	9.6	25.3	2.42
Green Skin Group			
Wilhelmsburger Trifolium X	9.6	27.0	2.59
Wilhelmsburger Otofte XI & F	8.7	30.0	2.61
Green Top	8.9	27.4	2.43

TABLE III

VARIETY	TOTAL YIELD	TOTAL YIELD DRY MATTER
	Tons/Acre	Ton/Acre
Broad Leaved Rape	11.7	1.6
Essex Rape	11.8	1.6
Dwarf Essex Rape	11.3	1.7
Giant English Rape	8.6	1.2
Svalof Matador Rape	7.9	1.1
Hungry Gap Kale	10.5	1.5

TABLE IV.

Fodder Beet Variety Trial

Variety	Percentage Root Dry Matter (28 Centres)	Yield of Roots (29 centres)	Yield of Tops (26 centres)	Yield of Root Dry Matter (27 Centres)
		Ton/Acre	Ton/Acre	Ton/Acre
Groenkragg CB	17.5	24.48	13.24	4.26
Yellow Daeno XI	15.2	26.16	13.37	3.94
Bison	16.1	26.40	12.32	4.27
Pajbjerg Korsroe XI	15.9	25.00	13.55	3.83

TABLE V.

Swede Variety Trial

Variety	Percentage Root Dry Matter (47 Centres)	Yield of Roots (51 Centres)	Yield of Root Dry Matter (47 Centres)
		Ton/Acre	Ton/Acre
Best of All	9.5	28.87	2.73
Tipperary	9.5	28.20	2.67
Bangholm Otofte XI	10.4	29.12	3.02
Wilhelmsburger Otofte XI and F	10.0	30.51	3.03

(c) GRASSES AND CLOVERS

V. Connolly

During the spring of 1960 samples were taken from old pastures in Limerick, Meath, Kildare and Tipperary. The object was to obtain populations of indigenous material from the best pastures; these should provide good germ plasma for future breeding and selection. From each of these samples, individual tillers of ryegrass, cocksfoot, and white clover, were taken and potted separately. Later these were transferred to the field as spaced plants.

Altogether some 2,000 ryegrass, 700 white clover, and 500 cocksfoot plants were obtained. During the year, considerable variation was evident among the individual plants and selections will be made next year. Although spaced plants are far removed from swards it is necessary to make initial selections from individual plants. Later, by using a suitable breeding technique (polycross method) sufficient seed can be obtained to test the parent material in small plots and to base further selection on the performance of the progeny in these sward plots as well as on spaced plant observation.

A large amount of seed samples of ryegrass, cocksfoot, meadow fescue, and timothy was obtained from the Department of Agriculture. These samples consisted mainly of polycross progeny of selected plants. They included four early and two late ryegrass selections and one selection each of cocksfoot and meadow fescue. Open pollinated samples of ryegrass, timothy, cocksfoot, and tall fescue have also been received. All the material has been sown in lines and spaced plants of the better families will be planted out next year for further selection.

CEREAL CHEMISTRY DEPARTMENT

P. Spillane, H. McGovern, K. McGrath

In September, 1959, facilities and equipment in the cereals laboratory of the Institute for Industrial Research and Standards were made available to An Foras Taluntais. The laboratory has continued the work on trials already in progress and commenced investigation into some of the more fundamental aspects of quality problems associated with the extended use of the native cereal crops.

For the period under review eight reports, dealing with the milling and baking quality of samples from the 1959 wheat trials, have been issued.

1. **The milling and baking characteristics of some winter wheat varieties from the 1959 harvest.**

The varieties examined were Milfast, Dominator, Starke and Yega. The baking quality of the Milfast and Starke samples was good and compared favourably with commercial spring wheat which was used as a control. Dominator and Yega had typical winter wheat characteristics and were considered unsuitable for inclusion in a bakers grist.

2. **The quality of some Atle-Progress selections from the 1959 crop, received from the Department of Agriculture.**

Five selections were examined and three showed excellent baking quality. The protein content of two of the samples was considerably higher than the commercial average and the quality was good. Starch viscosity was low for the season however and this might be a serious fault under less favourable harvest conditions.

3. **Fertiliser Trials - Johnstown Castle.**

The wheat used in these trials was Atle and all plots received a basal dressing of 4 cwt superphosphate and 2 cwt muriate of potash per statute acre. Sulphate of ammonia (21 per cent N) was applied at the rate of 0, 2, 4, 6, 8 and 10 cwt per statute acre. Two cwt was broadcast at sowing and repeated at fortnightly intervals until the whole dressing was applied.

A significant increase in protein content was obtained with treatments up to 8 cwt and distribution of nitrogen between bran and endosperm was normal at all treatment levels.

Flour viscosity figures, which normally show a considerable drop with increasing treatment remained constant for all levels. This

is attributed to the exceptionally hot and dry conditions prevailing during the ripening and harvesting period.

Despite the similarity of the analytical data there was a noticeable drop in baking quality with treatments in excess of 2 cwt per statute acre.

4. Commercial Wheats - 1959 Crop.

Fifty samples drawn from the principal wheat growing areas were examined. The yield of flour and flour colour was better than in any of the previous three years and the variation in the figures obtained over the complete range was small.

Diastatic and amylase activity was low and the amount of starch mechanically damaged during milling was small. The flour viscosity figures obtained on the amylograph were high but showed greater variation than expected.

The average protein content was about 1.5 per cent lower than in 1957 and 1958 crop wheats. The quality of the protein was about average and was somewhat weaker than in 1957.

Baking quality on the whole was good although some of the loaves showed a tendency to crumble. The quality of the batch bread from the large scale tests at the Curragh Bakery was excellent.

5. Fertiliser Trials - Moorepark.

These trials were laid down to investigate the effect of potassium and phosphorus at different levels and to determine the influence of sowing time on the response to nitrogenous fertiliser.

It is not possible at this stage to make any useful comment on the results obtained, as the field investigations are not sufficiently far advanced.

6. Comparison of the quality of the spring wheats Atle, Safir, selection 76 and selection 124, grown at different nitrogen levels at the Department of Agriculture farms.

The milling quality of the four varieties was good and the yield of flour similar.

Diastatic activity was low and the maltose figures for all the wheats were similar. The starch from the Safir samples appeared to be susceptible to mechanical damage during milling.

The protein characteristics of selection 76 were similar to Atle and superior to the other two varieties. The application of a nitrogenous top-dressing however had little effect on the characteristics of selection 76 but increased extensibility and reduced the general strength of the other three wheats.

The baking tests showed that the best bread at all treatment

levels was produced by Atle. The bread from selection 76 was somewhat better than that from Safir or selection 124 which in some cases was very poor.

7. **The effect of nitrogenous fertiliser on the quality of wheat grown continuously on the same area for 20 years.**

During 1958 and 1959, the first two years of this long term experiment, the weather was abnormal and the results obtained may not be as valuable as if conditions were closer to normal.

The plots received a basal dressing of 2 cwt superphosphate and 1 cwt muriate of potash per statute acre, and fertiliser treatments ranged from zero to 4 cwt per statute acre.

Results were in general agreement with previous experiments and indicate that the application of nitrogenous fertiliser in excess of 2 cwt per statute acre produces a noticeable drop in baking quality under Irish climatic conditions.

8. **Comparison of the milling and baking properties of the spring wheats Atle, Safir, selection 76 and selection 124 grown in the 1959 trials of the County Instructors in Agriculture.**

This was a most useful trial as apart from affording a comparison between the selected varieties under ordinary farming conditions, the figures for Atle can be used for crop record purposes as this variety forms the major part of the commercial crop.

The report on the 1959 crop has not yet been finalised but the results appear to confirm the findings on the samples received from the Department of Agriculture farms.

Baking results for average samples given below show the relative value of the four wheats.

SAMPLE	BREAD QUALITY	LOAF VOLUME
Atle	100	2230 c.cms.
Safir	75	2060 c.cms.
Selection 76	80	2080 c.cms.
Selection 124	60	1910 c.cms.

NEMATOLOGY DEPARTMENT

The research of this department is concerned with the study of the bionomics and control of plant parasitic nematodes. Host-parasite relationships, population studies and resistance are the main features of this programme. In addition to research the department also provides a routine service in connection with seed certification, quarantine and specialist advisory work.

POTATO ROOT EELWORM (HETERODERA ROSTOCHIENSIS)

J.J. Duggan

(a) Resistant material was screened against six different potato root eelworm populations. The material used and the results of the tests are as follows:-

MATERIAL	RESULTS AND OBSERVATIONS
(1) Diploid Solanum vernei.	No cysts formed.
(2) Tetraploid Solanum vernei (by Colchicine treatment).	No cysts formed.
(3) S. vernei x S. tuberosum hybrids.	None of the six clones tested were completely resistant against all six potato root eelworm populations. Cysts formed by the different populations varied from 0 - 130.
(4) Material bred from subsp. andigena Commonwealth Potato Collection 1673.	Of seven clones tested, five remained cyst-free. The sixth clone remained cyst-free against three of the potato root eelworm populations but the remaining three populations formed a small number of cysts (2, 4, 2.) on the roots of some of the plants. The seventh clone remained cyst-free against one population only. The other five populations formed cysts varying in numbers from 1 to 8 on plants grown from this clone.
(5) Material bred from Commonwealth Potato Collection 1690.	Screened against three populations. No cysts formed in two of these populations. Two cysts formed on the roots of one plant by the third population.
(6) Material bred from Commonwealth Potato Collection 1685.	Screened against three populations. Two of the populations formed one cyst on the roots of this material. The other population formed seven cysts on it.

(b) A total of 1920 soil samples were examined for potato root eelworm in connection with seed certification, quarantine and advisory work.

CEREAL ROOT EELWORM (HETERODERA AVENAE)

J.J. Duggan

Observations on host-parasite relationships and population studies were carried out on a field and microplot scale. It was observed that when a cold droughty period preceded and immediately followed the sowing of the crop, attack by the eelworm was not as severe as the initial level of infestation would lead one to expect. The drying out of the top layers of soil appears to limit the activity of the eelworm and plants become established before becoming heavily infested. When rainfall was high around sowing time an increase was observed in the injury due to eelworm attack.

Some 525 plant and soil samples were examined for cereal root eelworm.

Four varieties of oats, ten of barley and ten of wheat, were screened for resistance against two different cereal root eelworm populations (one from Galway and one from Kilkenny). None of the oat or wheat varieties tested gave any worthwhile evidence of resistance. One barley variety (Mannon) had a consistently low number of cysts on its roots and it was decided to re-test it in the coming season. The barley varieties X-C 11, Hunter and Proctor showed no evidence of resistance.

Wild oats (*Avena sterilis)* was also screened for resistance. It remained cyst-free when screened against the Galway population but cysts varying in numbers from five to 10 were formed on the roots of plants screened against the Kilkenny population.

BEET EELWORM (HETERODERA SCHACHTII)

M. O'Reilly, F. McGloughlin.

Studies on population trends under different cropping sequences and on host-parasite relationships were initiated at the Nematology Unit in Carlow where 105 microplots were constructed. These plots which are separate units measuring 6' by 4', were inoculated with beet eelworm and sown with beet.

Work was also commenced on screening material for resistance to beet eelworm using a population which was initially drawn from different areas. Thirty five lines of sugar beet were screened and and none of them were found resistant. *Beta maritima,* obtained in

Co. Kerry, was also screened and showed no resistance. Three plants of *Beta patellaris* remained cyst-free.

The possibility of clovers becoming infested with beet eelworm was investigated. Red and white clover were exposed to cysts, eggs and free larvae of beet eelworm in the soil and in no instance were viable cysts formed on the roots of the clover plants.

A preliminary experiment designed to determine the effect of different levels of eelworm infestation on the yield and sugar-content of sugar beet was carried out. Four levels of infestation were used, the different levels being obtained by bulking infested soil. Non-infested soil was used in the control plots.

The results were as follows:-

Level of Infestation	No. of Roots	Weight of Roots lbs.	Weight of Roots ozs.	Per Cent Sugar	Juice Purity	K	Na
.97 cysts/g.	13	4	13	17.1	88.4	6.36	.64
.72 "	14	8	11	16.8	88.7	6.52	.98
.48 "	13	8	3	17.2	88.5	5.0	1.14
.24 "	14	11	10	17.0	88.1	7.2	.74
Control	14	13	8	17.2	90.5	4.48	.76

A survey in relation to the occurrence of beet eelworm in Ireland was commenced on the 23rd May, 1960. By 31st December, 1960, 5516 samples were examined and two new cases of infestation were reported in the Kilmore area. The fields in question were adjacent to fields already known to be infested.

OTHER HETERODERA SPP.

J.J. Duggan

Studies have been carried out on *Heterodera* spp. found infesting the roots of dock (*Rumex crispus*). Cysts formed were observed to go through three colour changes viz. from white to yellow to light brown. The general cyst shape and vulval structures appear to be similar to those in cysts of *Heterodera schachtii*. *"Bullae"* are present and do not open directly to the *"fenestra."* The cyst-wall pattern consists of an irregular wavy line and appears to be derived from the original striation on the cuticle.

Males have been found and examined in detail. They appear to be similar to males of *Heterodera schachtii* and the tips of the spicules are bifid.

In the host-range tests carried out cysts did not occur on the roots of mangolds, sugar-beet, fat-hen, red clover, nettle, turnip, swede, cabbage, mustard, rape, groundsel, sow-thistle, speedwell, myosotis, poppy, sorrel. Cysts occurred plentifully on the roots of both *Rumex crispus* and *Rumex obtusifolius* and a few cysts were formed on white clover, dandelion and chickweed. One chickweed plant was found bearing 18 cysts. Studies on this species are continuing.

LEAF AND BUD NEMATODE (APHELENCHOIDES SPP.)

J. Moore

In connection with the scheme for the propagation of eelworm-free strawberries 700 runners were subjected to warm water treatments. The following varieties were treated:- Royal Sovereign, Cambridge Vigour, Talisman, and Red Gauntlet. Following treatment the pots containing the plants were bedded in peat moss and the plants were given an opportunity of recovering before being planted out.

As part of this scheme also, some 200 parent strawberry plants were examined for the presence of parasitic eelworms.

ROOT KNOT EELWORM (MELOIDOGYNE SPP.)

J.J. Duggan

Late in 1959 lettuce plants under glass were found to be severely attacked by a spp. of root-knot eelworm. Tomato plants weregrown in the same soil and were not parasitised. Studies were commenced on the morphology and host-range of the spp. involved.

A species of root-knot eelworm was also found occurring on sugar-beet in a soil which was being subjected to a growth-test for *Heterodera schachtii*. From the posterior cuticular pattern the species appears to be *Meloidogyne hapla* though the arches are rather higher than usual. The type of galling also suggests this species.

NEMATODE PESTS OF MUSHROOMS

J.J. Duggan, J. Moore

Nematodes are an important factor in the production of mushrooms commercially. Samples of mushroom compost and casing soil were

examined during the year and in all but one case the infesting nematodes were *Rhabditis* spp. In one instance the presence of *Ditylenchus myceliophagus* and *Aphelenchoides composticola* was recorded.

STEM AND BULB EELWORM (DITYLENCHUS DIPSACI)

J.J. Duggan, J. Moore

Host preference studies on a potato race and on an onion race of this eelworm were initiated. In connection with quarantine and advisory work 160 samples of bulbs, onion sets, clover seed, etc. were examined for *Ditylenchus dipsaci* infection.

TUBER-ROT EELWORM (DITYLENCHUS DESTRUCTOR)

J. Moore

This eelworm was recorded in Ireland for the first time in Autumn 1959. A survey was carried out and approximately 1200 tuber samples were examined. Studies on this eelworm were commenced in 1960 and are being continued. The following data have been obtained:-

(a) Morphology: Males and females have been examined and camera lucida drawings have been made. Diagnostic characters typical of the species have been noted, sketched and described.

(b) Host-range: The following potato varieties have been found susceptible to attack:-

Arran Banner	Home Guard	Ulster Commerce
Duke of York	Kerr's Pink	Ulster Torch
British Queen	King Edward	Up-to-date
Epicure	Record	Stormont Dawn
Garden Filler	Sharpe's Express	Irish Queen
Golden Wonder	Skerry Champion	Astra

Red and white clover were also recorded as hosts, all stages of the life-cycle being found in the roots of these plants. Coltsfoot, commint and woundwort were also attacked.

It was found that when clean seed was planted in inoculated soil the parent tuber became infested and the newly-formed tubers were attacked by the eelworm only when the parent tuber had decayed.

When infested seed was planted, the nematodes appeared to migrate from the seed into the soil from which they later attacked newly-formed tubers. Stolon damage was not observed and the number

of isolated feeding pockets found on newly-formed tubers indicated that the infestation of the latter occurs via the soil.

Generally no overground symptoms of attack were observed except in cases where heavily infested seed was planted. In such instances the seed either failed to produce a plant or produced a plant which was weak and stunted.

CROP HUSBANDRY DEPARTMENT

The work of this department may be grouped under main headings as follows:-

(1) Effect of cultural practices on the yield of crops.
(2) Introduction of new crops.
(3) Application of plant physiology to farm crops.
(4) Weed control investigations.

EFFECT OF CULTURAL PRACTICES ON THE YIELD OF CROPS

M. Neenan

The effect of harrowing and rolling on oats and barley was investigated at Johnstown Castle. These treatments showed no effect on yield or bushel weight. A trial with wide-row spacing, with and without inter-row cultivations caused no significant effect on the incidence of eyespot in barley.

On potatoes, it was found that burning off the foliage soon after blight appeared, resulted in an increased yield and a lower proportion of damaged tubers. The yield of good tubers where foliage was burned off was 101.33 cwt per acre and the yield of damaged tubers 10.37 cwt per acre. Where foliage was not burned off the corresponding yields were 80.12 and 14.14 cwt per acre respectively.

A trial on the combine drilling of flax showed that this method of applying fertilisers greatly reduced weed competition in the crop.

INTRODUCTION OF NEW CROPS

M. Neenan

Investigation on the following new crops was continued: hemp, maize and topinambour.

In the case of hemp an excellent yield of green material was obtained. This was subjected to three methods of retting, and the resulting materials taken to Co. Donegal for scutching. The yield of total scutched fibre was in the region of 1,300 - 1,800 lbs per statute acre. Samples have been sent abroad for quality evaluation.

Maize: Due to damage by birds in germinating stage yields from this crop were much inferior to those obtained in former years.

Topinambour: This was compared with potatoes, both crops receiving the same manurial and cultural treatments. The yield from topinambour was only two thirds of that obtained from potatoes although the latter were severely blighted in early August.

APPLICATION OF PLANT PHYSIOLOGY TO FARM CROPS

M. Neenan

Under this general heading, a number of experiments were undertaken. In one trial, seed potatoes (Epicure) were sprouted at three temperatures 40, 50 and 60° F (approximately) and planted in a typical potato growing area in South Wexford. At the time of planting, the potatoes stored at the highest temperature had the best sprouts. The effect on yield will be investigated at harvesting.

A small experiment on barley showed that high nitrogenous manuring or high N content in the grain was not correlated with low germinating capacity. The effect of nitrogenous manuring on the proportion of small grains (screenings) in wheat was also studied. The results to date have not been conclusive.

WEED CONTROL INVESTIGATIONS

Weed Control in Cereals

M. Neenan

Various formulations of MCPA and 2,4-D were compared for their effectiveness on a mixed weed population which included creeping thistle. The best yield of cereal was obtained from plots treated with the amine salt of 2,4-D. It is not possible to say whether this was due to more efficient control of the weeds, or to a lesser degree of injury to the crop.

Rejuvenation of Old Pasture

M. Neenan

In co-operation with the Grassland Ecology Department an experiment was undertaken on the rejuvenation of old pastures by sod-seeding, following treatment with Dalapon. The latter proved much slower in action than was anticipated, and no establishment of the sown seeds was obtained.

Weedcontrol in Sugar Beet

T.M. Thomas

An experiment comparing a number of different chemicals as pre-emergence weedkillers for weed control in sugar beet was laid down at Thurles. The chemicals used were Diuron/CIPC, OMU/BIPC and Fenuron/IPC mixtures. Each mixture was applied high-volume on the same day as the beet was sown. There were three different rates of application in each case.

CHEMICAL	RATE OF APPLICATION PER ACRE
Diuron/CIPC	1. 6 ozs Diuron + 3 ozs CIPC
	2. 8 ozs Diuron + 4 ozs CIPC
	3. 12 ozs Diuron + 6 ozs CIPC
OMU/BIPC	1. 6 ozs OMU + 4.25 ozs BIPC
	2. 8 ozs OMU + 5.5 ozs BIPC
	3. 12 ozs OMU + 8.5 ozs BIPC
Fenuron/IPC	1. 6 ozs Fenuron + 12 ozs IPC
	2. 8 ozs Fenuron + 16 ozs IPC
	3. 12 ozs Fenuron + 24 ozs IPC

Diuron = N-(3,4-dichlorophenyl)-N^1N^1 - dimethylurea.
CIPC = isopropyl 1-N-(3-chlorophenyl) carbamate.
OMU = cyclooctyldimethylurea.
BiPC = butinol-N-(3-chlorophenyl) carbamate.
Fenuron = N-(phenyl)-N^1N^1 - dimethylurea.
IPC = isopropyl-1-N-phenylcarbamate.

Weed control in all cases was quite satisfactory. Weeds controlled were *Spergula arvensis, Stellaria media, Chenopodium album, Sinapis arvensis, Urtica urens, Poa annua* and to a lesser extent *Polygonum* spp. *Senecio vulgaris* seemed to be resistant.

Initial growth of the beet seedlings was impaired by all the treatments especially at the higher rates of application and the beet plants in the treated plots seemed to have suffered from a more severe insect attack than those in the control (untreated) plots. While the beet plants in the treated plots were stunted in their earlier stages of growth they seemed to recover fully later in the growing season with little reduction in yield.

Analyses for amino nitrogen, sodium, and potassium content were carried out on the roots from harvested plots. There is evidence that

these, especially the amino nitrogen content, may be increased by application of the pre-emergence weedkillers used in this trial.

Control of the Common Rush (Juncus effusus)

T.M. Thomas

This experiment was laid down at the Pomology Research Centre, Dungarvan, in the first week of June, 1960.

The treatments were as follows:-

1.	MCPA	With cutting and removal of the rushes three weeks after application of the herbicide.
2.	2,4D	do
3.	2,4-D/2,4,5-T	do
4.	2,4-D.	No cutting
5.	Cutting only.	

The rates of application were:-

MCPA at 24 ozs acid equivalent (as potassium salt) per acre.
2-4D ester at 16 ozs acid equivalent per acre.
2-4D/2,4,5T mixture at 1 lb of 2,4-D(ester) + ½ lb 2,4,5T (ester) per acre.

To date best results have been obtained from an application of MCPA or 2, 4-D, the rushes being cut and removed three weeks after application of the herbicides. These treatments have given over 90 per cent reduction in rush cover. A reduction of 50 - 60 per cent has been obtained from an application of 2, 4-D without subsequent cutting of the rushes while cutting alone in the month of June gave only a 10 per cent reduction.

Further assessment of this trial is to be carried out during 1961.

Weed Control in Peas

T.M. Thomas

An experiment comparing the herbicides DNBP (amine), DNBP (ammonium) and MCPB for the control of weeds in peas was carried out at Thurles.

The herbicides were all applied as post-emergence sprays at the

following rates:-

DNBP (amine)	2.3 lbs per acre.
DNBP (ammonium)	1.5 lbs per acre.
MCPB (sodium salt)	2 lbs per acre.

The dominant weed species present were *Tussilago farfara* and *Agropyron repens*. Other weeds present were *Stellaria media, Chenopodium album, Sinapis arvensis, Polygonum persicaria* and *Papaver* spp.

DNBP amine and ammonium form gave 90 to 100 per cent control of most of the annual weeds except those in the more advanced stages of growth. Poor control of *Tussilago farfara* was given by these herbicides.

MCPA was not as effective in controlling the annual weeds as was the DNBP herbicides, giving poor control of *Stellaria media* and Polygonum persicaria. However, MCPB while not controlling *Tussilago farfara* seems to have affected this species.

PLANT PATHOLOGY DEPARTMENT

The work of the department, described in this report, has been concerned with diseases of cereals and root crops.

THE EFFECT OF METHOD AND RATE OF SEEDING ON TAKE-ALL, ON EYESPOT AND ON YIELD OF MALTING BARLEY

P.C. Cunningham

This seeding trial was laid down on a site that had carried four successive cereals susceptible to soil borne diseases. The seeding rates were five, eight and eleven stones and each rate was drilled and broadcast. Alternate sub-blocks received nitrogen (2½ cwt calcium ammonium nitrate/acre) at the braird stage.

Broadcasting of seed reduced the plant population but increased the number of shoots per plant. Rate of tillering was reduced with increased seeding. Top-dressing with nitrogen greatly increased the ear population. In the non top-dressed sub-blocks increased seeding increased the number of ears with both methods of seeding while with nitrogen increased seeding increased the ear number with broadcasting and reduced the figure with drilling. Heavy seeding increased lodging when nitrogen was applied. Broadcasting of seed delayed ripening as did thin seeding and nitrogenous top-dressing. Heavy seeding and nitrogen top-dressing gave more screenings and a lower thousand corn figure while broadcasting of the grain indicated an opposite effect. Nitrogen top-dressing was the only treatment that significantly affected the nitrogen content of the grain.

Mean figures for disease and yield were as follows:-

	Non Top-dressed					
	Broadcast			*Drilled*		
	Stones per acre			Stones per Acre		
	5	*8*	*11*	*5*	*8*	*11*
Per cent Straws with Eyespot	37	55	47	56	43	44
Per cent Straws with Take-All	94	94	91	92	92	99
Yield (cwts/acre)	28.3	30.0	30.4	29.2	29.2	29.0

	Nitrogen Top-dressed					
	Broadcast			Drilled		
	Stones per acre			Stones per acre		
	5	8	11	5	8	11
Per cent Straws with Eyespot	37	35	40	47	40	35
Per cent Straws with Take-All	89	87	98	95	94	93
Yield (cwts/acre)	31.4	31.9	33.3	34.4	32.5	31.8

While nitrogen did not appreciably affect take-all on the roots it increased yields considerably. Both eyespot and take-all showed a slight tendency to increase with increased seeding while method of sowing had no apparent effect. The yield figures indicate that there is a great difference in the optimum seeding rates for broadcasting and drilling as the trend indicates that it was nearer eleven stone for the former and five for the latter.

TRIAL ON OPTIMUM TIME OF NITROGEN TOP-DRESSING OF SPRING SOWN WHEAT IN RELATION TO YIELD AND SOIL BORNE DISEASES

P.C. Cunningham

Cropping history of the site of this trial was: 1959 - wheat; 1958 - wheat; 1957 - barley; 1956 - wheat. The variety was Atle and a basal dressing of 2½ cwts of 8 - 8 - 13 compound was drilled.

Treatments:

A. 3 cwts calcium ammonium nitrate at time of sowing.
B. 3 cwts calcium ammonium nitrate at early braird.
C. 3 cwts calcium ammonium nitrate at late braird.
D. 1 cwt calcium ammonium nitrate at time of sowing, early and late braird.
E. 1½ cwts calcium ammonium nitrate at time of sowing and late braird.
F. 1½ cwts calcium ammonium nitrate at time of sowing and early braird.
G. 1½ cwts calcium ammonium nitrate at early and late braird.
H. Control.

The incidence of weeds was greatest in plots which received all or part of its nitrogen top-dressing at time of sowing, next in plots top-dressed at the early braird stage and least in the control.

The disease levels for the different treatments are given in the following table:-

	Take-All Diseased Straws per cent			*Eyespot (slight)* Diseased Straws per cent	*Sharp Eyespot* Diseased Straws per cent
	Severe	Slight	Total		
A.	60.6	38.3	98.9	58.5	6.4
B.	63.8	34.3	98.1	46.3	5.0
C.	69.0	30.7	99.7	47.6	4.8
D.	64.9	33.7	98.6	51.6	3.9
E.	60.7	38.3	99.0	51.8	5.1
F.	54.9	43.9	95.8	50.4	4.5
G.	60.0	37.8	97.8	42.9	5.5
H.	67.6	31.1	98.7	42.3	4.7

Though total take-all was almost one hundred per cent for all treatments there is evidence that the percentage of straws severely infected with *Ophiobolus* was least when all or part of the nitrogen was applied at time of sowing. The occurrence of slight eyespot was greatest when plots were top-dressed at time of sowing and the figures for prevalence of *Cercosporella* seem closely related to a treatment's affinity for weeds. Sharp eyespot was uniformly low in all treatments.

The yield figures are given below in cwts/acre.

A	B	C	D	E	F	G	H
16.57	16.06	15.13	15.23	16.83	16.84	16.05	12.75

While the time of application and split nitrogen dressings yield trends relate to prevalence of severe take-all, the controls indicate that the considerable yield response to nitrogen is only very slightly due to actual control of take-all on the roots. It is unlikely that the treatment differential for eyespot would affect yield considerably as the lesions were all slight.

PILOT BARLEY VARIETY TRIAL UNDER CONDITIONS OF SEVERE TAKE-ALL

P.C. Cunningham

The varieties Banba, Herta, Ymer and Proctor were tested on a site heavily infested with scutch. The scutch was intensely colonised

by *Ophiobolus graminis*. The varieties were tested with and without a nitrogenous top-dressing (3 cwt calcium ammonium nitrate at braird stage).

Of the four varieties Banba gave the highest thousand corn weight and least screenings while Proctor gave most screenings and lowest thousand corn figure. The nitrogen content of the grain was significantly lower in Ymer than in the other three varieties.

Take-all Infection Level

Percentage Straws with Diseased Roots

	NON TOP-DRESSED			TOP-DRESSED WITH NITROGEN		
	Severe	Slight	Total	Severe	Slight	Total
Banba	67	31	98	55	41	96
Herta	66	33	99	70	29	99
Ymer	67	32	99	64	30	94
Proctor	53	44	97	62	37	99

In view of the high total infection there is no apparent varietal resistance in the four under test.

Mean Yield in Cwts/Acre

	NON TOP-DRESSED	TOP-DRESSED WITH NITROGEN
Banba	26.8	25.4
Herta	26.3	29.0
Ymer	28.6	29.2
Proctor	25.7	27.2

It seems possible that Ymer may have greater tolerance of take-all than the other varieties though the fertility status may have favoured this more than the other varieties.

METHOD AND RATE OF SEEDING OF ATLE WHEAT UNDER CONDITIONS OF SEVERE TAKE-ALL

P.C. Cunningham

This was the fifth successive cereal on the site. A basal dressing of 8 - 8 - 13 compound was broadcast at 5 cwts/acre at time of sowing. The rates of seeding were 15, 12, 9 and 6 stone/acre and each rate was drilled and broadcast. Replication was sixfold.

Counts at the braird stage revealed that the plant population was reduced by broadcasting and by low seeding, but a higher tillering rate approximately offset the difference between the two methods of sowing for total shoots. Ear counts, however, showed that the ear population was influenced considerably by seeding rate and to some extent also by sowing method. The grain samples with highest thousand corn weights were from the six and nine stone broadcast treatments.

The following table gives the percentage whiteheads and yields:-

Method of Seeding	Broadcasting				Drilling			
	Stones				Stones			
Rate of Seeding	15	12	9	6	15	12	9	6
Percentage Whiteheads	14	11	5.1	3.7	17.5	19	14	10
Yield (cwts/acre) 20 per cent moisture	15.20	15.09	16.46	16.77	13.49	14.24	15.51	15.43

In a preliminary examination of the roots of plants showing the whitehead condition it was found that all had severe take-all. The disease diagnosis on stubble and roots for the experiment has not yet been completed.

RELATIVE TOLERANCE OF WHEAT AND BARLEY OF TAKE-ALL

P.C. Cunningham

It was evident from wheat and barley plots grown alongside that take-all has not an equal depressing effect on both species. Though barley was not appreciably resistant to take-all (94 per cent infected), it yielded 32 cwts/acre while wheat (98 per cent infected) yielded only 16 cwts.

DOWNY MILDEW OF SUGAR BEET (PERONOSPORA SCHACHTII)

C. Comerford

Thirty-seven strains of sugar beet and three samples of *Beta maritima* grown in a greenhouse during the spring were sprayed regularly with a spore suspension of *Peronospora schachtii* in order to determine their relative resistance to this organism. The results confirm those already obtained at Thurles, that the tetraploids are not as susceptible to downy mildew as the diploids. On an average

the tetraploids become infected to the extent of 23.9 per cent while 32.2 per cent of diploids showed symptoms. The polyploids with 29.6 per cent mildewed plants were intermediate in position as might be expected.

Two of the *Beta maritima* samples failed to germinate and the third proved to be very susceptible with only two plants out of a total of 85 remaining free.

Investigations on the resistance of three diploid and two tetraploid strains of sugar beet to *Peronospora schachtii* with a view to selecting resistant plants were carried out in a field isolated from commercial crops of beet. The two tetraploids and two of the diploids had previously been shown to possess some resistance to downy mildew while the remaining diploid was included as a source of inoculum as it was found to be the most susceptible to this malady in previous trials. These plants were sprayed with a spore suspension once a week for ten weeks commencing on the 1st June. The first fructifications of downy mildew were seen on a few plants scattered throughout the plots on the 17th June. A notable feature of the early infections on young plants was that the fructifications usually appeared in patches on the under side of the outer leaves and not on the young heart leaves. As the plants increased in size, the infection spread rapidly throughout the plots when it was observed that the attacks were usually confined to the growing point and rosette of young leaves.

The percentage infection at the final count made on the 17th October was as follows:-

STRAIN 138/1	DIPLOID = 37.52
STRAIN 167	DIPLOID = 37.18
C.N.B.	DIPLOID = 62.7
STRAIN 170	TETRAPLOID = 24.59
STRAIN 180	TETRAPLOID = 32.68

Downy mildew-free plants have been selected from all the varieties except the C.N.B. for further breeding work.

BLACKLEG OF SUGAR BEET (PHOMA BETAE)

C. Comerford

Sugar beet plants were artificially inoculated with *Phoma betae* by different methods, to investigate:-

(a) the amount of rotting resulting from such inoculations
(b) the source from which this rotting arises and
(c) the effects of this disease on the yield of seed produced.

Unfortunately this trial did not give much information as actively growing plants did not become infected while weak plants and decaying shoots became severely infected. This indicates that *Phoma betae* is a weak parasite and that it is not such a serious problem in sugar beet seed crops as one would think from examining such crops at harvest time.

WILT OF MANGELS

C. Comerford

Severely wilted plants selected during the year were microscopically examined for the presence of a pathogenic organism, but in no case was any found. Numerous attempts to transmit this wilt to healthy mangel seedlings by aphid and sap inoculations were unsuccessful.

A survey of the areas in which wilt of mangel occurs, which was to be carried out during the summer was postponed due to the condition of the seed crops. Most of these crops were so severely affected with Virus Yellows, which masks the symptoms of wilt, that it was impossble to estimate with any accuracy the extent of the wilt.

CLUB-ROOT DISEASE OF CRUCIFERS (PLASMODIOPHORA BRASSICAE)

C. Comerford

While working on club root, zoosporangia were found in the root hairs of grasses grown on soil heavily infected with *Plasmodiophora brassicae*. These zoosporangia were indistinguishable from those found in the root hairs of club root infected crucifers. Earlier workers on club-root have observed these zoosporangia in non-crucifers, ten species of which have been recorded as being susceptible. To test further the occurrence of zoosporangia in non-crucifers twenty-two species were grown in soil heavily infested with *Plasmodiophora brassicae*. Of the twenty-two species inoculated, twelve contracted infection, eight of which have not previously been recorded as susceptible to club-root. The species not previously reported as susceptible to *Plasmodiophora brassicae* are barley, Italian rye grass, white clover, mangel, lamb's quarter, mouse-ear-chickweed, red

shank and cleavers. Infected root hairs from the above plants have been used in attempts to infect swedes, but so far this has not been successful. It is intended to try different methods in future experiments.

CHEMICAL CONTROL OF CLUB ROOT OF CRUCIFERS

C. Comerford

A trial on the control of club root by the use of different chemical treatments was carried out on heavily-infested land at Kilsallaghan, Co. Dublin. The trial was laid down in an effort to find a suitable chemical for the control of club root in market garden areas. Mercuric chloride is the recognised standard treatment, but as this substance is very corrosive to equipment and extremely poisonous to humans it cannot be generally recommended.

In the experiment there were ten fungicidal treatments and a control. The treatments which were applied at transplanting were as follows:-

CHEMICAL USED	RATE OF APPLICATION
Mercuric chloride	½ pt. per dibble hole
Pentachloronitrobenzene (PCNB)	½ pt. per dibble hole.
Zineb	½ pt. per dibble hole
Maneb	½ pt. per dibble hole
Thiram	½ pt. per dibble hole
Captan	½ pt. per dibble hole
Aldrin	½ pt. per dibble hole
Control - Water only	½ pt per dibble hole

In addition there were three calomel treatments:-

(a) 1 oz pure calomel to 1 pint water
(b) 2 oz pure calomel to 1 pint water
(c) 1 lb 4 per cent calomel to ⅓ pint water

A hundred cabbage plants were dipped in (a), (b) and (c) and transplanted immediately. All the calomel treated plants got half pint of water after planting.

Healthy cabbage plants were planted on June 24th in a randomized block layout in which there were four blocks, each of 11 plots. Each plot consisted of 40 plants. Two days after planting all plants were treated with dieldrin to eliminate damage from cabbage-root fly.

The plants were harvested on 19th September. The numbers of marketable plants were recorded and those plants were then cut just below the lowest leaf and the tops were weighed. All the root systems were then dug up, washed and graded for club root on the following scale:-

Grade 0.	Free	No clubbing visible.
Grade 1.	Indeterminate	Roots too decayed to allow assessment of clubbing.
Grade 2.	Slight	One to a few small swellings on lateral roots only.
Grade 3.	Moderate	Numerous small swellings on lateral roots only.
Grade 4.	Severe	Large clubs wholly or chiefly confined to the lateral roots.
Grade 5.	Very Severe	Tap root and laterals, if still recognisable, heavily clubbed.

The disease index readings and yield data were analysed by analysis of variance, the results of which are given in the table.

MEAN YIELDS AND CLUB ROOT GRADES

CHEMICAL	No. Marketable heads per plot	Weight Marketable heads per plot (lb)	Club Root Index per plant (max 5)
Mercuric chloride	27.25	64.0	2.98
Calomel (c)	22.0	45.75	3.24
Calomel (b)	29,75	66.25	3.73
Aldrin	26.0	55.88	3.75
Thiram	32.0	65.50	3.93
Maneb	32.75	69.88	3.99
Calomel (a)	22.25	44.5	4.17
PCNB	33.75	78.25	4.20
Captan	29.25	64.50	4.25
Zineb	28.25	67.25	4.43
Control	13.5	24.88	4.63
S.E. for treatments	2.8	10.03	0.13

The number of marketable heads was significantly lower in the control than in all treatments though two of the calomel treatments (a) and (c) also recorded low yields. All treatments with the exception of (a) and (c) caused a significant increase in weight of marketable heads.

With the exception of captan and zineb all the treatments gave a significantly lower infection index than the control. Mercuric chloride

controlled the disease significantly better than all treatments except (c).

Though mercuric chloride controlled the disease better than all treatments except one it did not give a correspondingly high yield and six of the treatments gave a higher number of marketable heads. The highest yield was obtained from PCNB in spite of the fact that it gave a high infestation reading. However, this treatment did not give a significantly better yield than mercuric chloride.

The results so far obtained serve to pave the way for further experimentation and this preliminary trial shows that some of the fungicides tested are not very promising and that greater emphasis should be placed on the rate of application of the more promising ones.

CHEMICAL SOIL DRESSINGS FOR CONTROL CLUB ROOT OF CABBAGES

C. Comerford

A trial to compare the effectiveness of three different chemicals used as soil dressings for the control of club root was laid down on land heavily contaminated with *Plasmodiophora brassicae*.

The treatments were as follows:-

(1) Calomel at a rate equivalent to 18 lb. per acre.
(2) Pentachloronitrobenzene at a rate equivalent to 75 lb per acre.
(3) Aldrin at a rate equivalent to 5.6 lb per acre.
(4) Control - untreated.

These dusts were carefully broadcast on the appropriate plots three days before planting and the soil surface was forked to ensure incorporation of the fungicide in the top four to six inches of soil.

Transplanting was carried out on 23rd June. A randomised block layout was employed with five replications of each treatment. Each plot contained 60 plants - four drills of 15 each. On 25th June every plot in the experiment was given a dressing of dieldrin to ensure control of cabbage root fly.

The centre 26 plants only in each plot were harvested on 12th September and the results are given in the table. Harvesting and

assessing the disease were carried out similarly to the way described in the previous experiment.

MEAN YIELDS AND CLUB ROOT GRADES

CHEMICAL	No. Marketable heads per plot (26 plants)	Weight Marketable heads per plot (lb)	Club Root Index per plant (max 5)
Calomel	19.4	46.8	3.36
PCNB	20.4	43.4	3.62
Aldrin	18.8	37.9	4.32
Control	11.6	21.9	4.47
S.E. for treatments	1.6	4.2	0.11

All the treatments caused a considerable and significant increase in yield but there was no significant difference between the three treatments.

The club root index of the plants receiving calomel and PCNB was significantly less than that of the aldrin treated plants and the control. There was no significant difference between the calomel and PCNB treatments.

The general indication from this experiment was that aldrin at the rate applied had very little effect upon the disease even though it significantly increased the yield. Further experimentation will be carried out with these chemicals using different rates of application.

RESISTANCE TO CLUB ROOT IN TURNIPS, SWEDES AND CABBAGES

C. Comerford

Varieties of swedes, turnips and cabbages reputed to be resistant to club root were grown on land heavily infected with *Plasmodiophora brassicae*. The object of the work was to test the resistance and yielding capacity of the different varieties on land heavily contaminated with the club root organism.

Swedes: In this trial three varieties of swedes reputed to be resistant were compared to the susceptible variety, Best of All. None of these were found to be immune under the conditions in this test, though two of them were very resistant and the third showed some degree of resistance. The varieties and percentages of infected

plants were as follows:-

Best of All = 24.0 per cent.
Bongholm Otofte X I = 10.87 per cent.
Wilhelmsburger Otofte X I & F = 3.25 per cent.
New Zealand Wye = 1.0 per cent.

There was evidence that the infection was unevenly distributed in the soil and also because of the low level of infection even in the susceptible Best of All it would be unwise to draw definite conclusions. The white fleshed Wye and Wilhelmsburger are very promising.

Turnips: Five turnip varieties claimed to be resistant to club root were compared to the susceptible variety, Aberdeen Green Top. In this trial the number of plants that became infected with club root was so small that no conclusions could be drawn. The varieties tested and the percentages of infected plants were as follows:-

Aberdeen Green Top = 3.54 per cent.
Dale's Hybrid = 5.41 per cent.
Yellow Tankard = 6.45 per cent.
The Wallace = 1.45 per cent.
The Bruce = 4.16 per cent.
Irvine's Green-top Yellow = 0.2 per cent.

These varieties and others found to be resistant on the continent will be used in greenhouse tests in the coming year. Field trials with the club root organism are not entirely reliable, since many susceptible plants may escape infection due to uncontrollable environmental factors.

Cabbage: The resistance of four American varieties of cabbage was tested on land heavily infected with *Plasmodiophora brassicae*. Three of these were found resistant at Wisconsin and the fourth which was susceptible was sent for comparison purposes. The variety Greyhound was also included in the test.

All the plants of the susceptible varieties Wisconsin All Seasons and Greyhound were severely affected as were over 90 per cent of the plants of Badger Shipper, 192259A and 8359T. The American varieties gave high yields in spite of the fact that they were severely infected. These varieties were also very susceptible to ringspot *(Mycosphaerella brassicicola)*.

TESTING OF NUCLEUS POTATO STOCKS

J.B. Loughnane, Jean McKay, U.C.D.

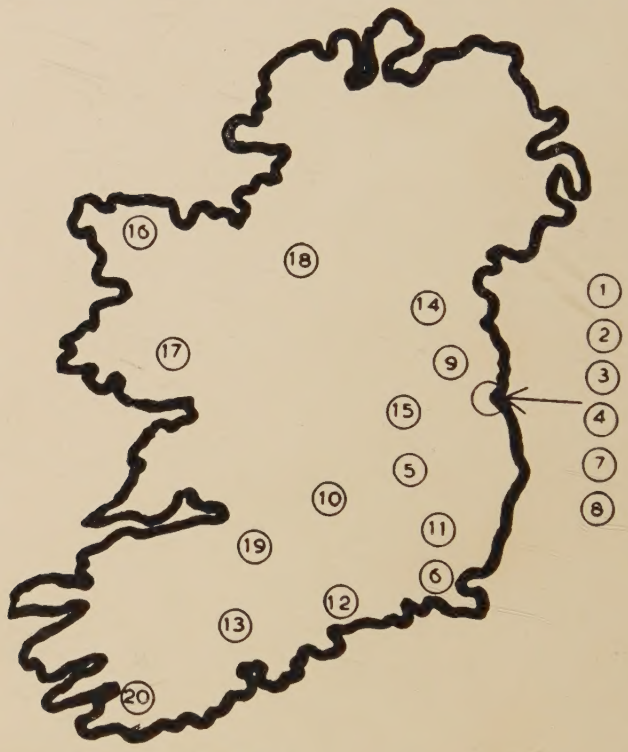
The nucleus stock of virus-free tubers maintained at the Plant Pathology Department, U.C.D. has been extended to include units of 50 varieties. Units of 16 varieties hitherto considered to be virus-free had been found to be infected with virus S. Through further selection and testing, virus-free units of five of these varieties have been obtained and added to the virus-free collection. Tubers of 20 varieties were supplied from the virus-free collection to supplement the virus-free collection maintained in isolation by the Department of Agriculture in Donegal.

The results obtained with virus S and X antisera produced in this Department were found to compare favourably with those obtained with similar antisera received from the Institute for Flowerbulb Research, Lisse, Holland. An antiserum against potato virus Y was obtained from Holland but its use as a test method for this virus proved unsatisfactory. However, the symptoms produced by the common strains of potato virus Y in potatoes are clear and characteristic so that it is not proposed to continue the serological method as a routine test for this virus.

In an attempt to obtain virus-free stocks of some of the more recently introduced and of some of the older potato varieties, tests were carried out on the progeny of many selected plants. The results were disappointing in so far as all units tested were found to be virus-infected. Of the plants of the variety Royal Kidney tested, five were found to be infected with virus S only and a stock from these is being maintained until a virus-free stock becomes available.

Tests were carried out on the progeny of 25 tubers each of six varieties selected from nucleus "virus-free" stock thrice grown in isolation in Donegal. The purpose of these tests was to ascertain if any viruses had infiltrated into such stocks. In only one case was a plant found to be infected with a virus - in this case virus S. The presence of virus S in this stock can be explained on the basis that the virus was already present in the nucleus stock when first grown for propagation. It was not the practice at that time to test nucleus stocks for the presence of virus S.

RESEARCH CENTRES OF AN FORAS TALUNTAIS



1. Headquarters, Merrion Road.
2. Animal Production Division Headquarters, Dunsinea, Castleknock, and temporary laboratories. Thorndale, Drumcondra.
3. Rural Economy Division Headquarters, Ballsbridge (in course of building) and temporary offices Kildare Street.
4. Horticulture and Forestry Division Headquarters, Vegetable and Glasshouse Research Centre & Soil Physics Dept., Kinsealy, Malahide.
5. Plant Sciences and Crop Husbandry Division Headquarters, Agricultural Engineering Dept. (Oakpark) & Nematology laboratory, Carlow.
6. Soils Division Headquarters, Johnstown Castle, Co. Wexford.
7. Cereals Laboratory, Glasnevin House, Ballymun Road.
8. Plant Pathology Unit and Nematology Unit, Glasnevin.
9. Animal Production Research Centre, Grange, Co. Meath.
10. Sugar Beet Breeding Research Centre, Thurles.
11. Soft Fruits and Beekeeping Field Station, Clonroche, Co. Wexford.
12. Pomology Research Centre, Dungarvan.
13. Dairying Research Centre, Moorepark, Fermoy.
14. Applied Plant Genetics Unit, Kells Ingram Farm.
15. Peatland Experimental Centre, Lullymore, Co. Kildare.
16. Peatland Experimental Centre, Glenamoy.
17. Sheep Research Centre, Creagh, Ballinrobe.
18. Soil Physics (Drainage) Field Station, Ballinamore.
19. Economic Test Farm, Herbertstown.
20. West Cork Survey Headquarters, Skibbereen.